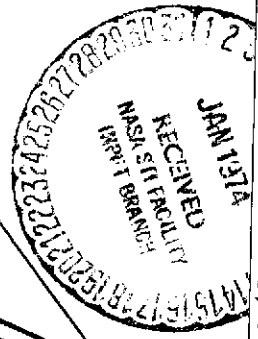


USERS GUIDE TO HIGH ALTITUDE IMAGERY OF MICHIGAN

**COLOR ILLUSTRATIONS REPRODUCED
IN BLACK AND WHITE**



(NASA-CR-136222) USERS GUIDE TO HIGH
ALTITUDE IMAGERY OF MICHIGAN (Michigan
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The Users Guide to High Altitude Imagery of Michigan was authored by Mark C. Sullivan and Stephen W. Schar of Michigan State University's Project for the Use of Remote Sensing in Land Use Policy Formulation. The graphics were prepared by Peter N. Gibson and Patricia Hagedon. Professor Myles Boylan, Director of the School of Urban Planning and Landscape Architecture and Dr. Raymond D. Vlasin, Chairman of the Department of Resource Development are the Principal Investigators for the MSU Project. In its overall project, MSU cooperates closely with the Environmental Research Institute of Michigan, previously called the Willow Run Laboratories of the University of Michigan.

In addition, the effort at Michigan State University involves staff from the Department of Forestry and the Department of Crop and Soil Sciences as well as the Michigan Agricultural Experiment Station.

USERS GUIDE
TO
HIGH ALTITUDE IMAGERY
OF
MICHIGAN

April 1973

PROJECT FOR THE USE OF REMOTE SENSING
IN LAND USE POLICY FORMULATION

Michigan State University

This report is a guide to the high altitude imagery of Michigan available through the National Aeronautics and Space Administration (NASA) and the Earth Resource Observation System (EROS) Data Center. It outlines for the Michigan user those areas of the state covered by selected recent high altitude aircraft and Earth Resources Technology Satellite flights and describes the type of imagery taken. The text intentionally avoids technical descriptions of the sensors used; that information is available in other publications.*

The flight coverage areas shown on the various maps in this document are approximate. To determine the exact boundaries of the imagery, contact the Project for the Use of Remote Sensing in Land Use Policy Formulation at Michigan State University.

TYPES OF REMOTE SENSING AVAILABLE

Earth Resources Technology Satellite

The Earth Resources Technology Satellite (ERTS-1) was launched on July 23, 1972 by NASA to provide high altitude images of the Earth for research purposes. The satellite, first in a proposed series, orbits the Earth in a NE-SW direction, passing over the same spot every 18 days at an altitude of about 920 kilometers (572 miles). The orbital passes over Michigan are shown in Figure 1.

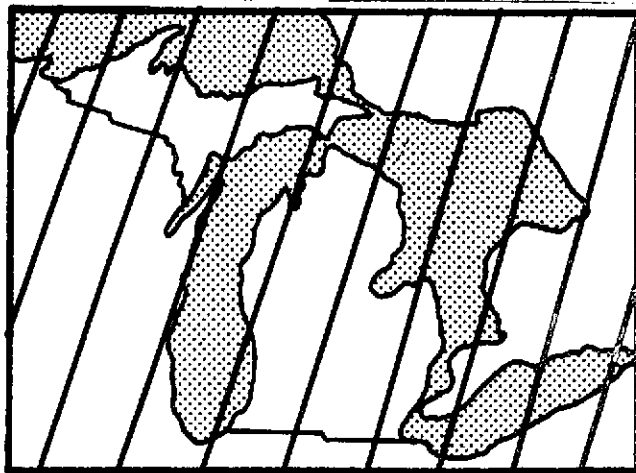


FIGURE 1

* Aircraft Remote Sensing Systems, MSC-05118, Manned Spacecraft Center, Houston, Texas, 1971.

* Earth Resources Technology Satellite Data Users Handbook, General Electric, Space Division, Valley Forge Space Center, P.O. Box 855, Philadelphia, Pennsylvania 19101.

The ERTS-1 Satellite contains two types of remote sensing equipment: (1) a return beam vidicon (RBV) camera, which has not operated since shortly after the launch; and (2) a multispectral scanner (MSS). The scanner detects spectral radiation from the Earth's surface and records the amount of radiation detected on magnetic tape. These data are then transmitted to ground receiving stations and compiled as an image using an analog printer called an electron beam recorder (the magnetic tapes may also be used for computer processing without producing an image). This printer translates the recorded amounts of radiation into small cells of light or dark shades at 4003 cells per 70-mm. (2 $\frac{1}{4}$ ") long printed line, and 4312 of these lines per 70-mm. frame to form a picture. ERTS images are produced in a 70 X 70-mm. format called a frame.

The ERTS multispectral scanner produces images of the Earth's surface with radiation from four different segments or bands of the electromagnetic spectrum, each within or close to the range of light visible to the human eye. Each of the bands (Table I) of the spectrum, (green, red, near infrared, and intermediate infrared) accents different features of the Earth. Figure 2 shows an August 21, 1973 image of west central lower Michigan (Lansing - Grand Rapids) for each band of light.

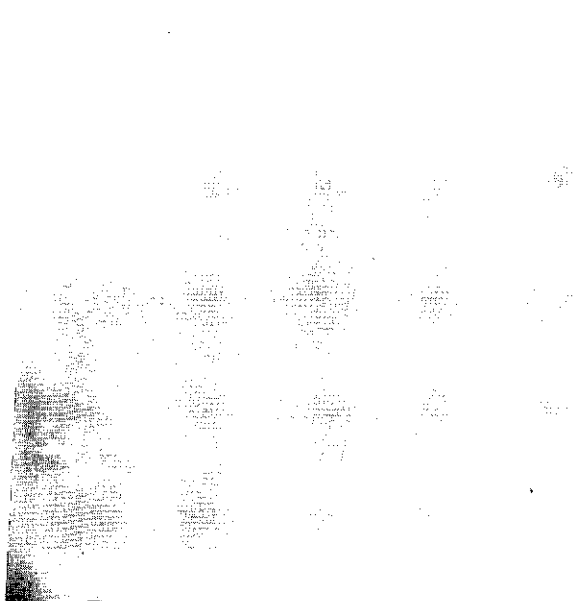
TABLE I
ERTS SATELLITE BAND SIZE AND COLOR

Band	Wavelength (Micrometers)	Color
4	.50 - .60	green
5	.60 - .70	red
6	.70 - .80	near infrared
7	.80 - 1.10	Intermediate Infrared

A listing of the available ERTS-1 Imagery and its quality can be obtained from either the Remote Sensing project at MSU or the Earth Resources Observation System Data Center in Sioux Falls, South Dakota. A more detailed report on the interpretation of ERTS imagery will soon be available from this project.

ERTS satellite imagery is available in black and white prints or transparencies for each of the four bands. These scenes are at a scale of 1:1,000,000 (10" X 10" frame), and show an area of about 100 nautical (115 statute) miles on a side. At this scale only very large or gross features can be recognized, i.e., urban areas, forests, sand dunes, water bodies, and agricultural areas. For example, a 40 acre field would be the smallest sized area that is visually identifiable with minor (3x) magnification.

ERTS-1 COVERAGE OF LANSING - GRAND RAPIDS AREA



BAND 4



BAND 5



BAND 6



BAND 7

FIGURE 2

Each band emphasizes different features. Band four, often distorted by haze, may best be used for identifying underwater features. Band five seems to accent urban and agricultural areas. Agricultural features are also easily identified in band six, which shows surface water features as well. Band seven, however, has excellent haze penetration capability and shows the presence of surface water best. To aid in interpretation, a color composite is created by reproducing three bands (four, five, and either six or seven) in different colors (yellow, red, and blue). This adds color to the features when the three images are superimposed, providing the interpretation advantages of three bands rather than one.

ERTS imagery seems particularly useful for the state or regional planner, as it allows him to get a good overview of his planning area. For detailed use, however, lower level imagery is more valuable.

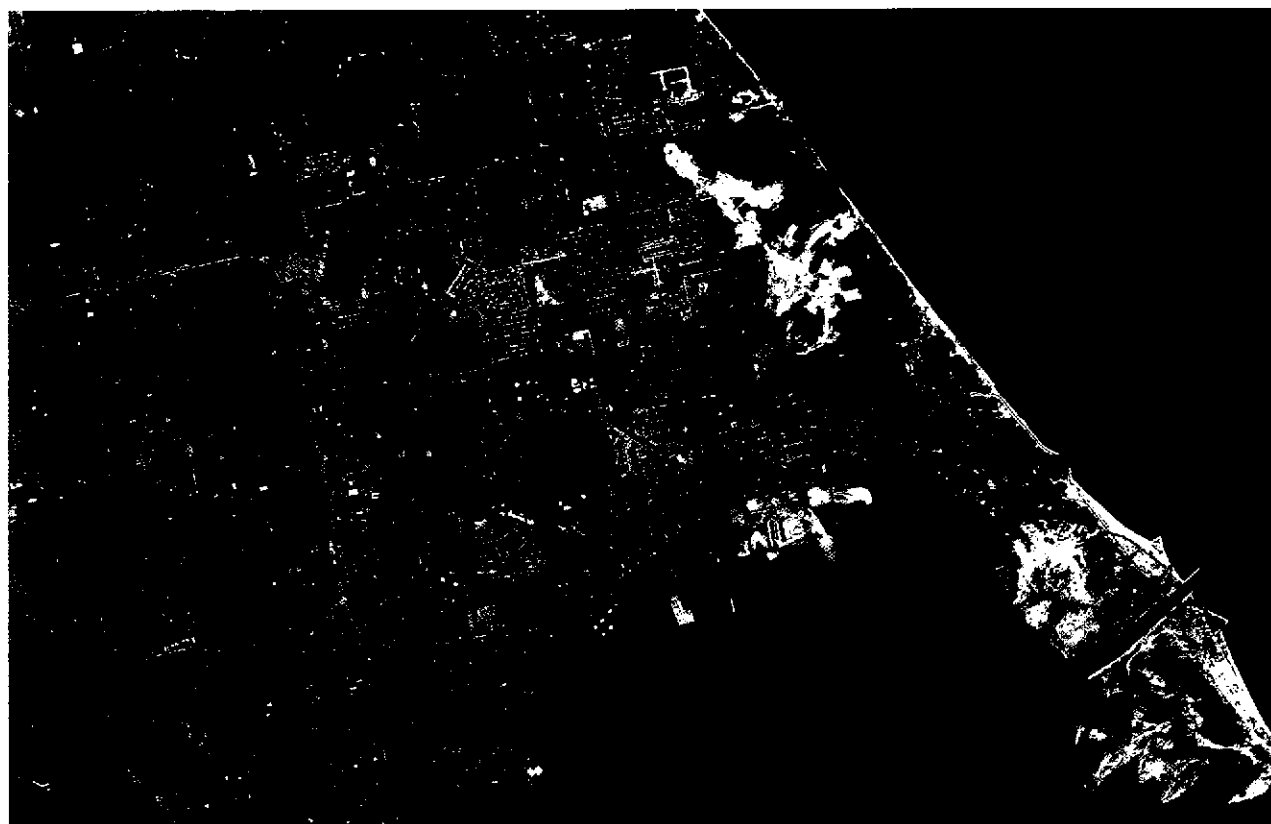
High Altitude Aircraft

The NASA Earth Resources Aircraft Program conducts high altitude missions to collect multispectral photographic imagery of selected study areas. These missions are usually flown with the NASA/Air Weather Service RB-57F Aircraft at an altitude of about 18,000 meters (60,000 feet).

The sensors which normally collect data on these flights consist of two RC-8 cameras with a 6-inch focal-length, a 12-inch focal-length Zeiss camera, and six 70-mm. Hasselblad cameras. Various film and filter combinations are used, depending on the objectives of the mission. Color infrared (Figure 3) and color films are used nearly exclusively in the RC-8 and Zeiss cameras which produce a 10" X 10" negative. Black and white panchromatic and often black and white infrared film is used in the Hasselblad cameras which produce 70-mm. square photograph.

Photographic coverage of the RC-8 cameras is usually planned for a 60 percent end overlap and 20 to 30 percent side overlap. Coverage by the Zeiss and Hasselblad cameras usually has a 10 percent end overlap and a 0 to 10 percent side overlap. However, overlap varies widely when differing lens combinations are used.

Additional factors may limit the usefulness of the imagery gathered by the sensors. Aircraft equipment or camera malfunctions may shorten a mission or prematurely end coverage by one or more of the cameras. Adverse cloud conditions usually defined as exceeding 40 percent, may shorten a flight or cause gaps in coverage at critical points. Lighting conditions or glare may cause improper film exposure. Certain film has shown unexplained spotting or color



RB-57 COLOR INFRARED IMAGERY
MUSKEGON, MICHIGAN

TOP PHOTO-1:120,000

BOTTOM PHOTO-1:60,000

discrepancies and processing accidents have obscured some imagery. Finally, slight aircraft navigation errors may result in excessive coverage of some areas and inadequate coverage for others.

All things considered, better than 75 percent of the high altitude coverage of Michigan is not only usable, but excellent in quality and clarity. Clouds and their ground shadows comprise nearly all of the unusable remainder.

In addition to the RB-57 coverage of Michigan, two flights of U-2 coverage were made across the lower peninsula. The U-2 uses a Vinten camera system to photograph in discrete bands of light ranging from .475 to .900 micrometers. The aircraft usually flies at about 20,000 meters (65,000 feet) to provide imagery at a scale of 1:446,000. (This means one unit on the photo is equivalent to about 446,000 units on the ground.)

High altitude photography is valuable for a variety of uses. The scales vary but tend to be large enough for fairly detailed interpretation (1:60,000 is equivalent to about 1 inch on the photo equaling one mile on the ground). RB-57 imagery comes in two different types: conventional color and color infrared. With color photography, the interpreter sees images exactly as he would if viewing from an aircraft. Features are seen in their correct colors and easily identified. Color photography also provides excellent water penetration, which enables identification of underwater objects. Unfortunately it has poor haze penetration qualities, and often provides an obscured or hazy image.

Color infrared photography often provides a more useful product than conventional color photography. Color infrared (CIR) photography recodes most of the visible energy and some infrared radiation reflected from the earth. The CIR film is sensitive to green, red, and infrared radiation, rather than the blue, green, and red of conventional color films. Hence, a false color image is produced from infrared film. Green vegetation, for example, is shown as red. This is because vegetation reflects larger amounts of infrared radiation than green. Usually a yellow filter is used to filter out violet and blue light. Figure 3 shows the use of two different types of filters. In the top photo a small amount of blue light is filtered out, while in the bottom a larger amount of blue is filtered out. The resultant photograph indicates the value of each filter, particularly in water penetration (slight on the top, none on the bottom).

Color infrared photography is most useful in interpreting agriculture, forests, and other forms of vegetation, as different types of vegetation and their condition are shown by different shades of red. Man-made features are also

readily visible due to their light color which strongly contrasts the vegetation. Finally, due to the excellent haze penetration capabilities of infrared photography, it provides a sharp, clear image from high altitudes. Water penetration, however, is quite poor, ranging from none to about three feet.

At scales of 1:120,000 and 1:60,000, the RB-57 aircraft imagery is particularly valuable for urban and regional planning. Agencies such as the Lansing Tri-County Planning Commission and the Michigan Department of State Highways have found this imagery particularly valuable in their work. It is used for environmental analysis, land use mapping, and natural resource inventory.

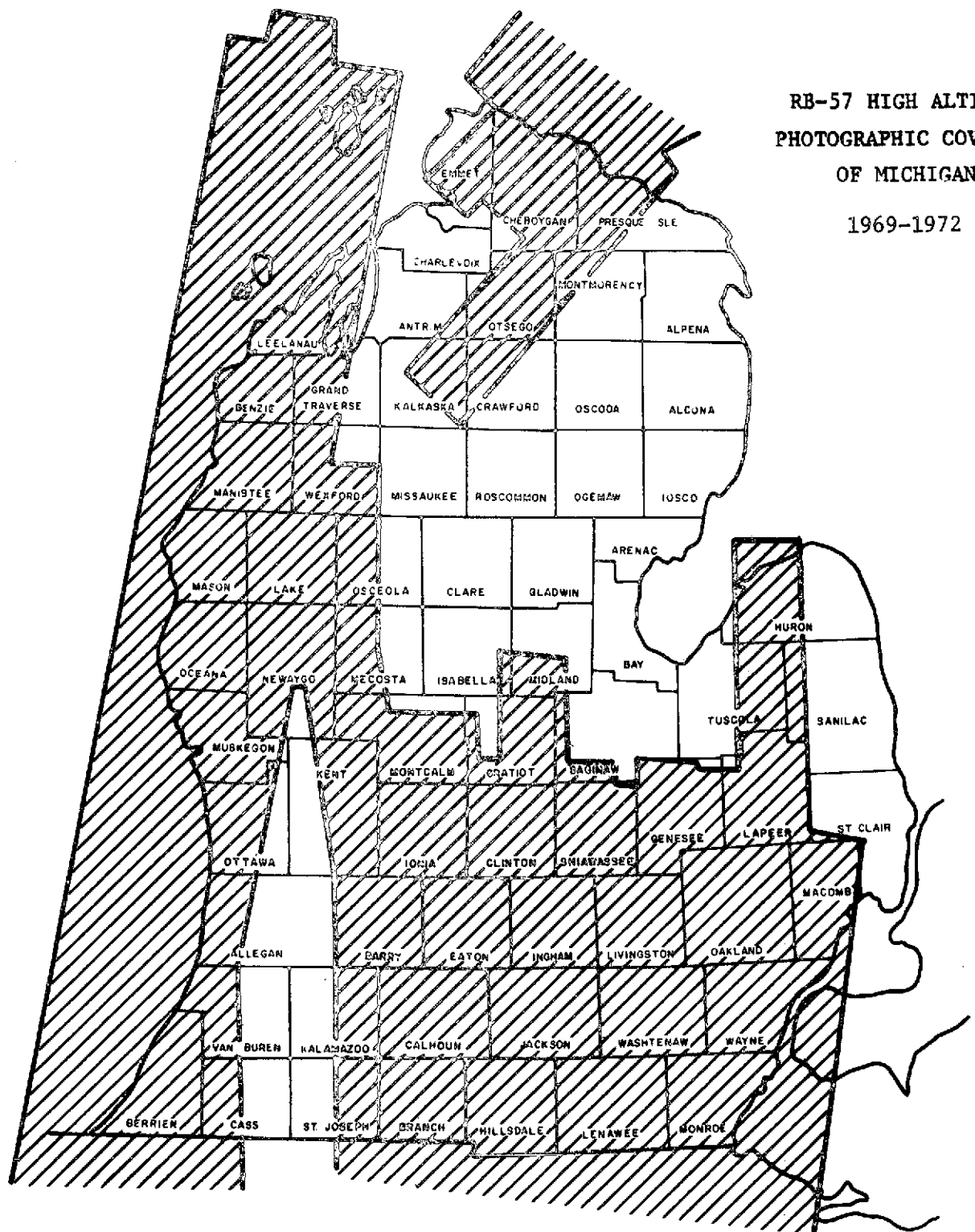
HIGH ALTITUDE PHOTOGRAPHIC COVERAGE OF MICHIGAN

Since September 1969, the Earth Resources Aircraft Program has provided photographic coverage of nearly 40 percent of the land area of Michigan. This coverage is concentrated in the lower peninsula (See Figures 4 and 5) where more than 55 percent of the land area has been covered to date. Usable imagery is available for approximately 70 percent of that area.

In addition, imagery from these flights is available for nearly 40 percent of the state's total length of shoreline, with more than two-thirds of the lower peninsula's shoreline covered. Thus, from the standpoint of developing an Inventory of Michigan's resources and land use, an excellent base of imagery is available. Since these photographs were gathered over a 3-year span during three seasons of the year, differences in vegetation, water levels, and land use over time are evident and must be accommodated when used.

Ten RB-57 missions and one U-2 mission are described in this guide. (A second U-2 mission had 100 percent cloud cover, and did not provide usable coverages.) Some of these missions involve test sites over more than one area of Michigan. Since each flight mission was undertaken for a specific research purpose, the sensors carried on the aircraft may differ between missions. (Table II shows the extent of coverage in each county of Michigan.) Potential users of this information should be aware of such possible differences. The following section outlines specific information about each mission.

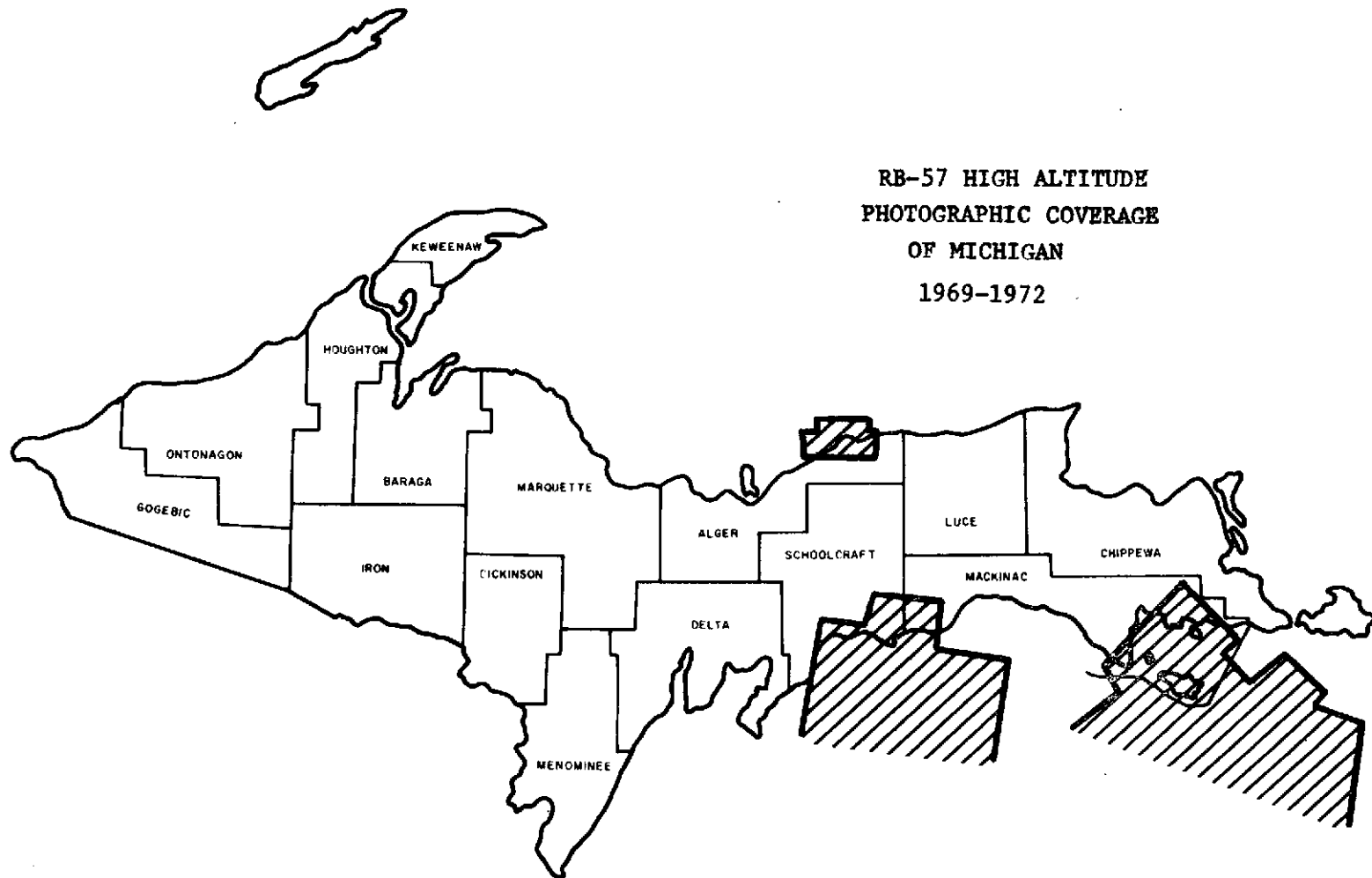
RB-57 HIGH ALTITUDE
PHOTOGRAPHIC COVERAGE
OF MICHIGAN
1969-1972



0 50 miles

FIGURE 4

RB-57 HIGH ALTITUDE
PHOTOGRAPHIC COVERAGE
OF MICHIGAN
1969-1972



0 50 miles

FIGURE 5

TABLE 11 - RB-57 COVERAGE BY COUNTIES

County	Mission										
	103	111	128D	132	144	145	166	174	205	211	U-2
Alger		P									
Antrim					P						
Allegan	P				P						
Barry								P*	P	P*	
Benzle											
Berrien	T				P*		P*				
Branch	P						P	P	T	T	
Calhoun	P							P	T	T	
Cass	P				P		P				
Charlevoix	P										
Cheboygan					P*						
Clinton	P*							P*	T	T	P
Crawford					P						
Eaton	P*							P	T	T	
Emmet					P*						
Genesee	P*		P						P	P*	P
Grand Traverse	P*										
Gratiot								P*	P*	P	
Huron								P			
Hillsdale	T						P		T	P	
Ingham	T			P		P	P	P*	T	T	
Ionia								P	T	T	P
Isabella								P			
Jackson	T			P		P	P	P	T		
Kalamazoo								P			
Kalkaska					P						
Kent								P*		P	P
Lake	P*									T	
Lapeer	P		P*					P*		P	
Leelanau	T				P						
Lenawee	T			P*		P	P		T		
Livingston	T			P*		P*	P*		T	T	
Mackinac	P				P						
Macomb	P*							P			
Manistee	T									P	
Mason	T									P*	
Mecosta								P		P	
Midland								P			
Monroe	T			P		P		P	T		P
Montcalm								P	P*	P*	
Montmorency					P						
Muskegon	P*				P						P
Newaygo	P*								P	P*	
Oakland	T		P*	P		P		P	P*	P	P
Oceana	T				P					P*	
Osceola										P	
Otsego					P						
Ottawa	P*				P						P
Presque Isle					P*						P
Saginaw								P	P*	P	
Sanilac								P			
Schoolcraft	P										
Shiawassee	P*										
St. Clair	P										
St. Joseph								P			
Tuscola								P			
Van Buren	P				P		P				
Washtenaw	T			P*		P*	P*		T	P*	
Wayne	T		P					P*	P*		P
Wexford	P									P	

T = Total Coverage

P = Partial Coverage

* = Over 50% Coverage

MISSION 103 - September 1969

Mission 103 was flown over two test sites on September 10 and 12, 1969. Test Site 167 was covered by four flight lines running north and south along the eastern edge of Lake Michigan (Figure 6 and 7). Coverage extended from a point southwest of South Bend, Indiana to Manistique in the Upper Peninsula of Michigan. Cloud cover obscured a portion of the extreme southern end of each of the flight lines.

Nine cameras were used, with color infrared (CIR) film in both an RC-8 and a Zeiss camera. One RC-8 used conventional color film while the six Hasselblads held black and white. The flight was made at an altitude of 18,000 meters (59,000 feet).

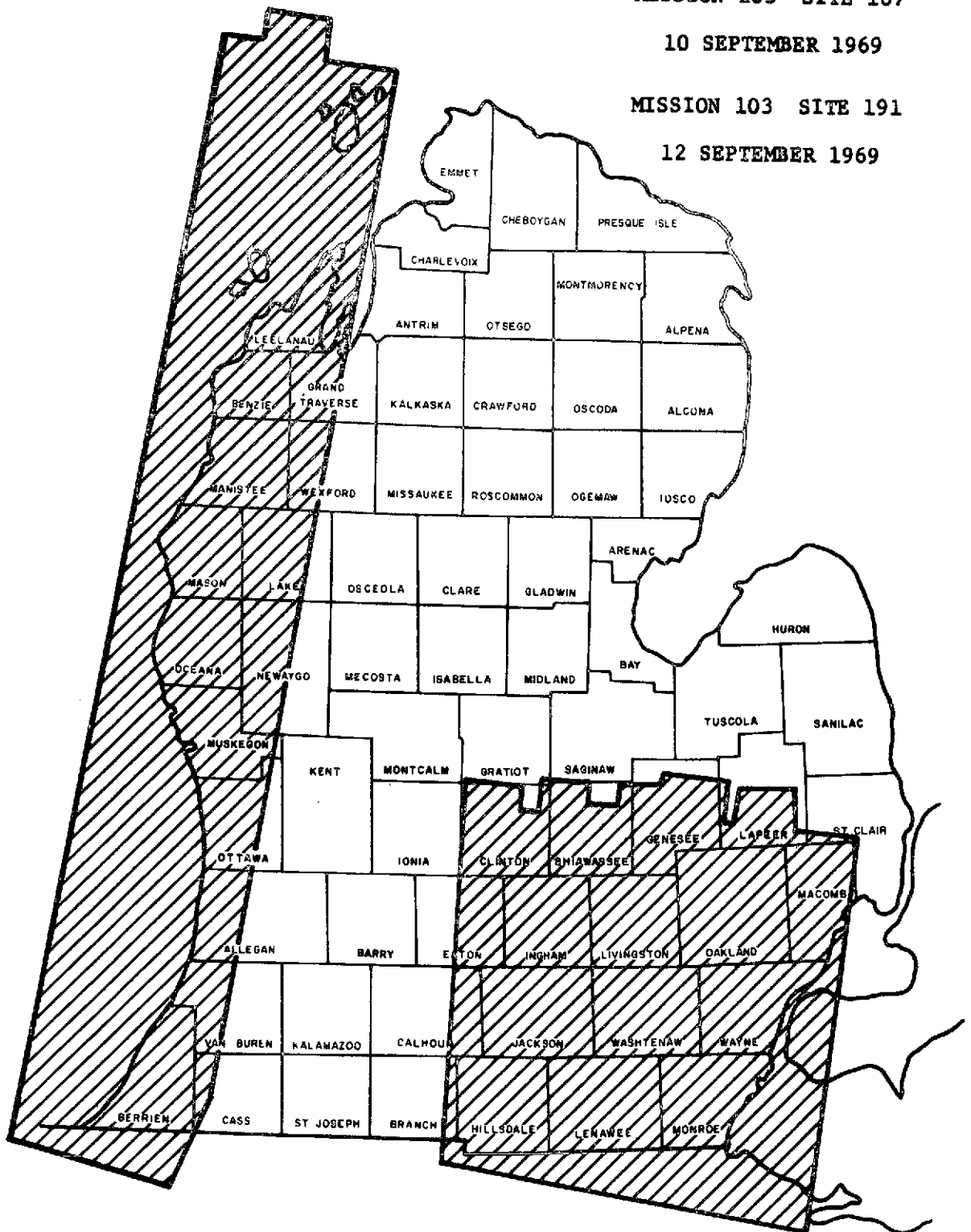
Test Site 191, flown on September 12, 1969, was covered by 10 flight lines running north and south. The site extended from approximately the southern border of the state to a line north of Flint. Although nine cameras were carried, only the RC-8's and the Zeiss were operated over the entire mission. One RC-8 and the Zeiss held CIR film; the other RC-8 used conventional color. The Hasselblad cameras, operated only during the four flight lines covering Washtenaw County, contained a mixture of black and white, panchromatic, and black and white infrared (BWIR) film. The first five flight lines (the western half) are somewhat under-exposed. This flight was also made at about 18,000 meters (59,000 feet) above ground.

MISSION 103 SITE 167

10 SEPTEMBER 1969

MISSION 103 SITE 191

12 SEPTEMBER 1969



0 50 miles

FIGURE 6



MISSION 103 SITE 167

10 SEPTEMBER 1969



FIGURE 7

MISSION III - October 1969

Mission III, Test Sites 196 and 208, was flown on October 15 and 17, 1969 at low altitude [about 670 meters (2200 feet)] over an area of Lake Superior Shoreline west of Grand Marais State Park (Figure 8). Both multispectral photography and thermal scanner imagery were obtained. Eight cameras were used, with one RC-8 using CIR and one with conventional color film. The six Hasselblad cameras were equipped with a variety of color, black and white, and BWIR film. However, all Hasselblad imagery was judged too dark to print, and thus is not available. The CIR imagery is also dark on Site 196. Only a few frames were taken due to a variety of adverse conditions (clouds, reflection, etc.).

Three flight lines were covered in an east-west pattern at an altitude ranging from 670 - 850 meters (2200 to 2800 feet). The thermal scanner imagery collected was entirely in the thermal range of the spectrum. The scanner imagery was collected between 670 and 1060 meters (2200 and 3500 feet) elevation. Only a few frames of this site are available and their quality is excellent.



0 50 miles

FIGURE 8

MISSION 128D - July, 1970

Mission 128D, Test Site 231, was flown on July 5, 1970 over a north-south line from approximately Highland Park to a few miles north of Lapeer, Michigan (Figure 9). It was flown at an altitude of about 19,000 meters (62,500 feet). Seven cameras were used, with one RC-8 and a Zeiss containing CIR film and the other RC-8 holding conventional color film. Four Hasselblad cameras were carried, two with black and white, one with BWIR, and the fourth with CIR film. Excellent photography was obtained.

MISSION 128D SITE 231

5 JULY 1970

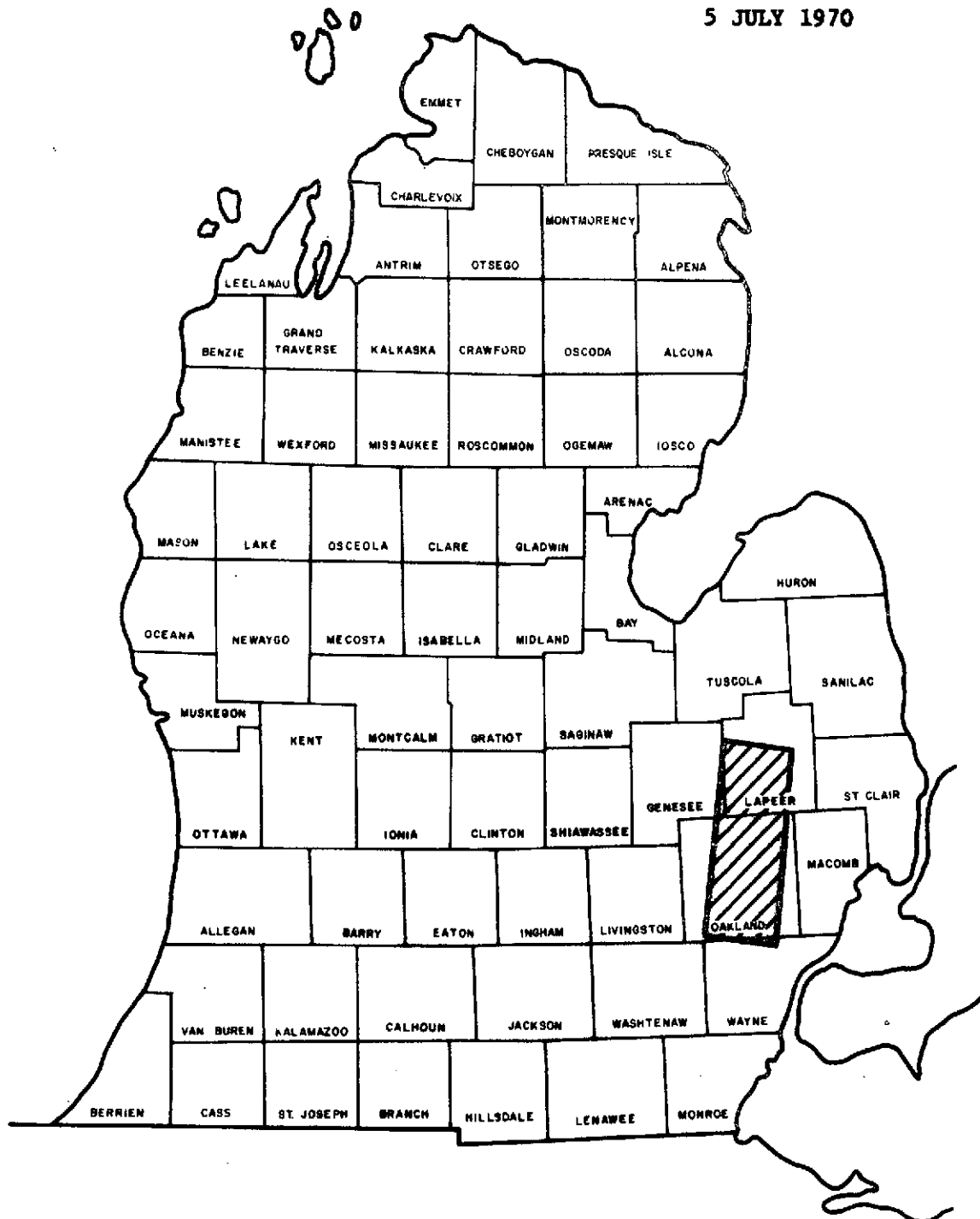


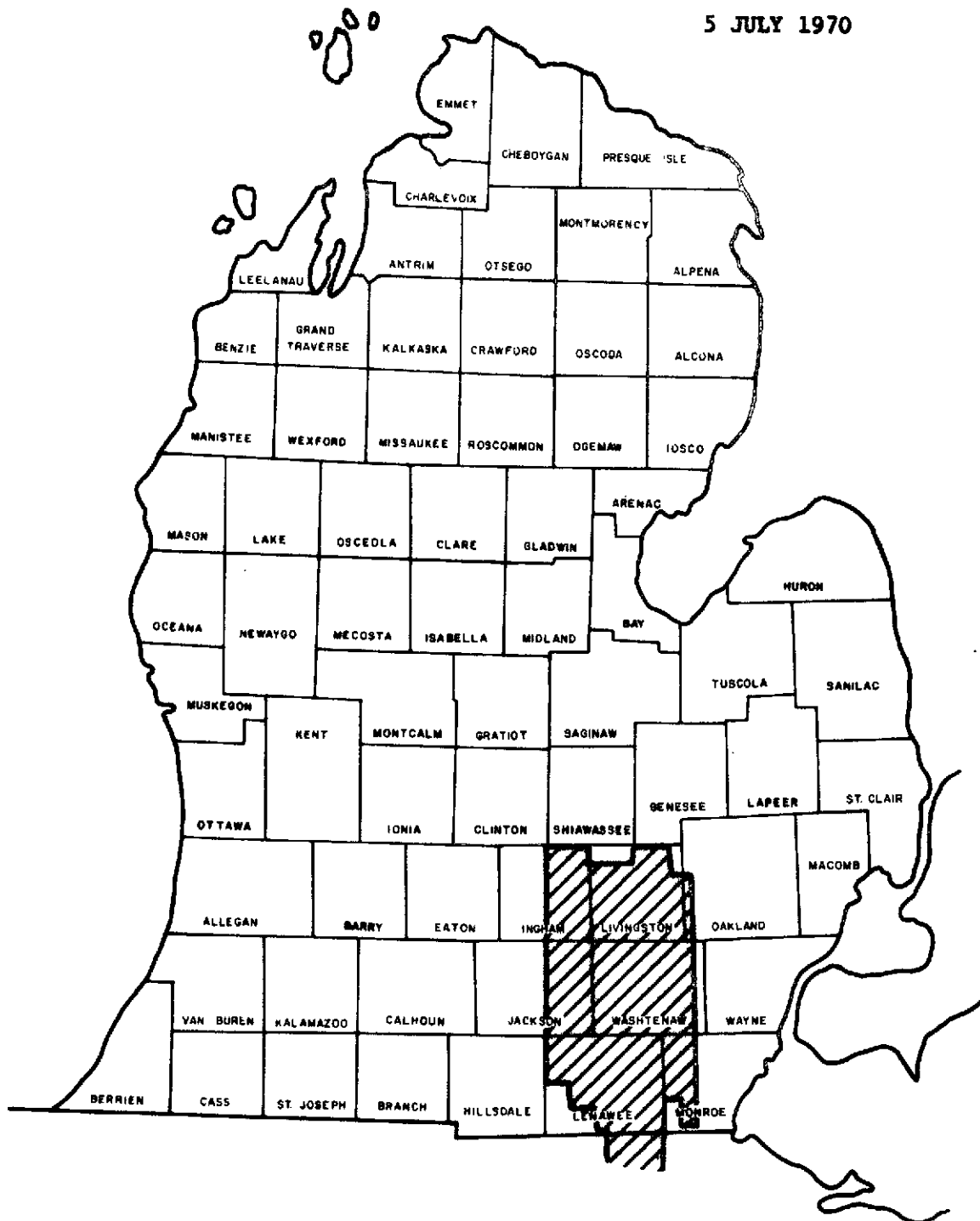
FIGURE 9

MISSION 132 - July, 1970

Mission 132, Test Site 190, was also flown on July 5, 1970 over eight north-south flight lines running from about the Ohio border to the northern boundary of Livingston County (Figure 10). Scattered clouds were encountered during the flight, but most of the Imagery is of excellent quality. Again, nine cameras were carried in the aircraft; one RC-8 and a Zeiss held CIR while a second RC-8 held conventional color film and six Hasselblads carried a variety of black and white panchromatic, BWIR and CIR films. The data was collected at an altitude of between 12,500 and 12,557 meters (41,000 and 41,200 feet) above ground. An additional shortened line over Ann Arbor was obtained at about 19,000 meters (62,700 feet) elevation.

MISSION 132 SITE 190

5 JULY 1970



0 50 miles

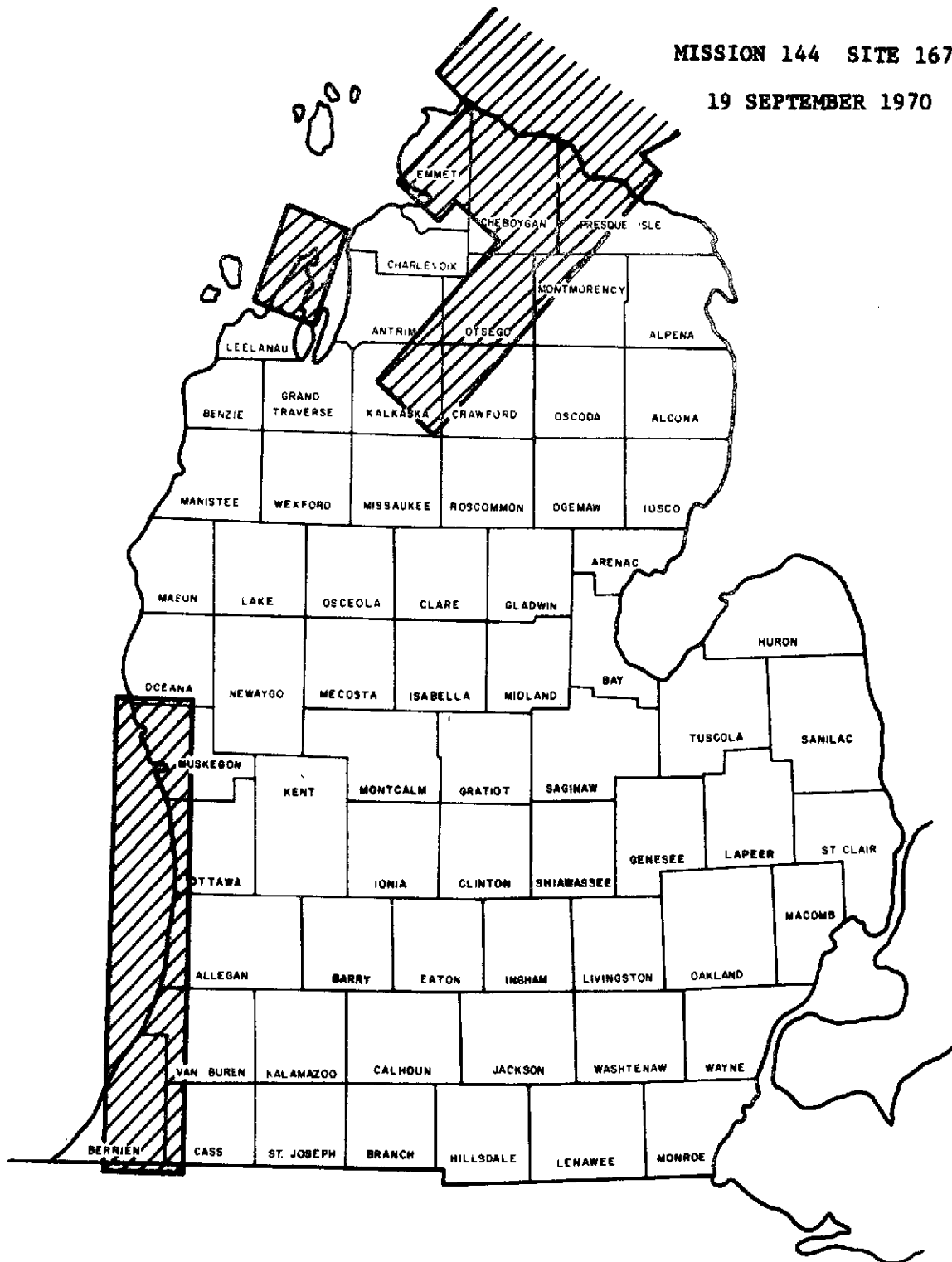
FIGURE 10

MISSION 144 - September 1970

Mission 144, Test Site 167, was flown on September 19, 1970 over three scattered areas along the western and northern edges of Michigan's lower peninsula (Figure 11 and 12). One flight line was flown from the Indiana border north to a point just north of Whitehall, Michigan. Near total cloud cover ended the line at that point. The second line is over the northern half of Leelanau County. The third through sixth flight lines cover the Lake Huron shoreline from Rogers City to Mackinac City and extend inland nearly as far as Cadillac. The flights were made at approximately 18,200 meters (60,000 feet) above ground. One RC-8 and a Zeiss camera carried CIR film, a second RC-8 contained conventional color film. The imagery is excellent.

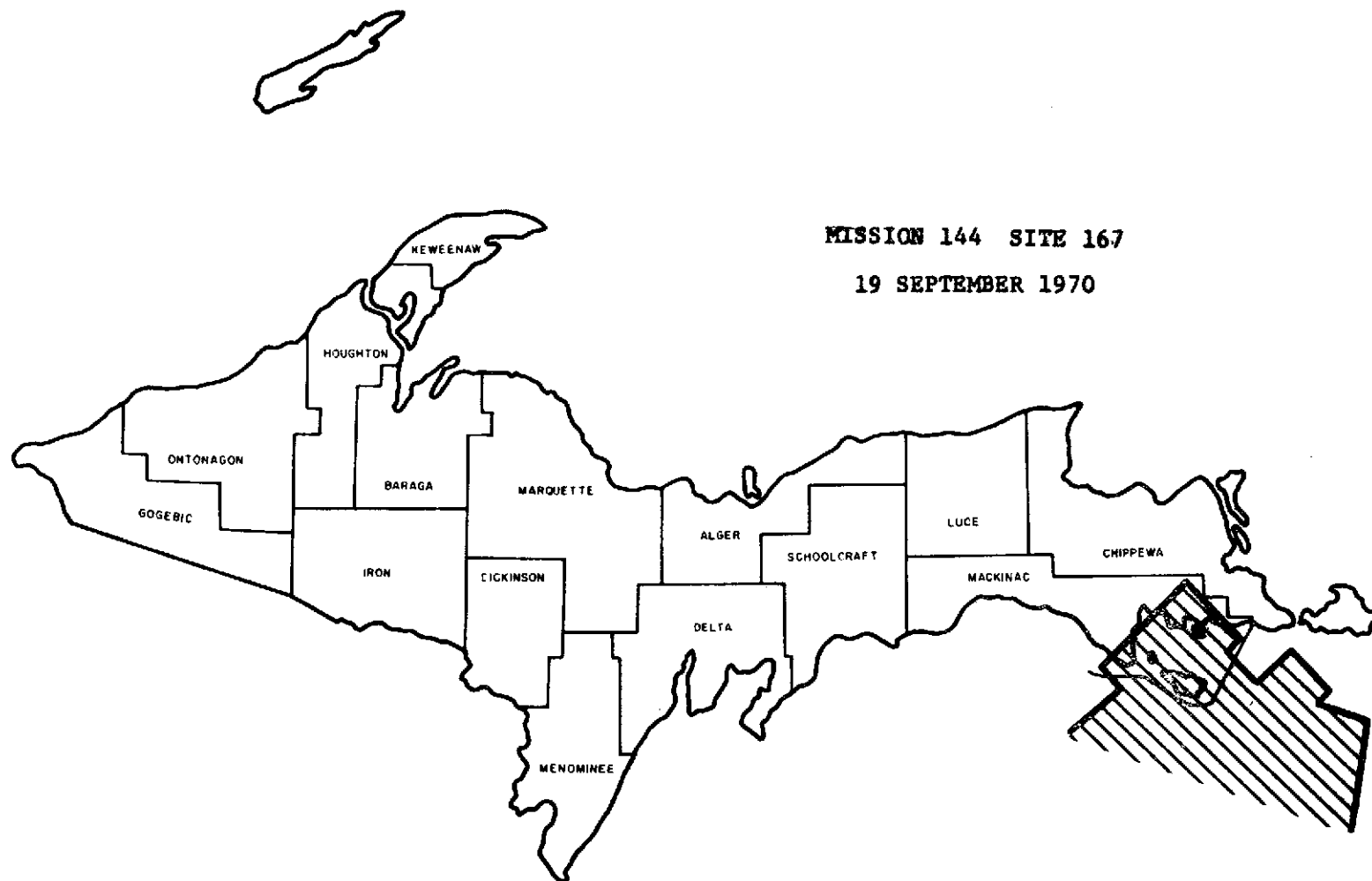
MISSION 144 SITE 167

19 SEPTEMBER 1970



0 50 miles

FIGURE 11



MISSION 144 SITE 167

19 SEPTEMBER 1970



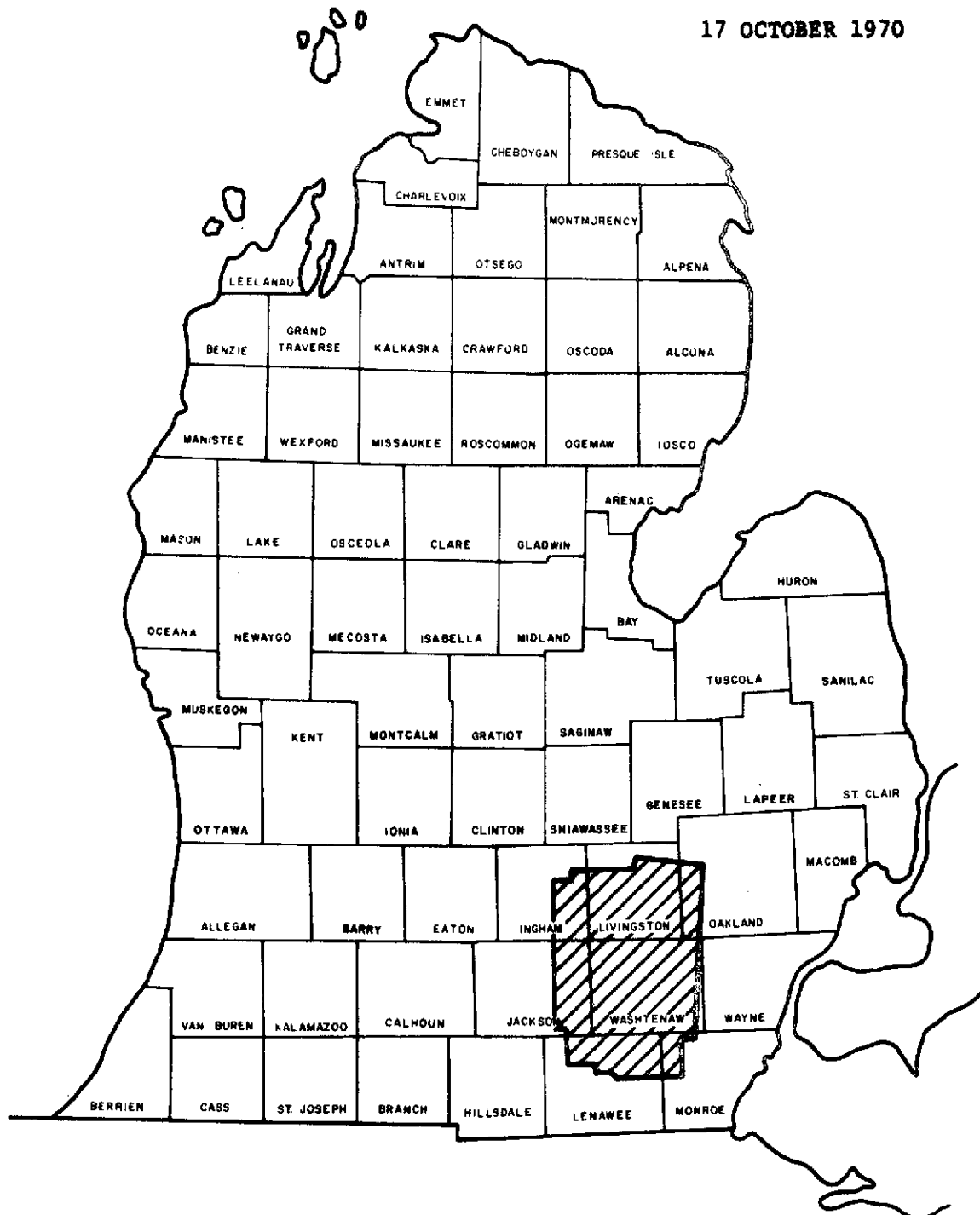
FIGURE 12

MISSION 145 - October 1970

Mission 145 was flown over Test Site 190 on October 17, 1970. In eight north-south flight lines, it covered an area from about Tecumseh on the south, to Howell on the north (Figure 13). The flight altitude ranged between 17,920 and 18,200 meters (58,000 and 59,300 feet) above ground level. Nine cameras were used, an RC-8 and Zeiss containing CIR and a second RC-8 using conventional color film, and six Hasselblads containing a variety of black and white, BWIR, and CIR films. The imagery is excellent.

MISSION 145 SITE 190

17 OCTOBER 1970



0 50 miles

FIGURE 13

MISSION 166 - May 1971

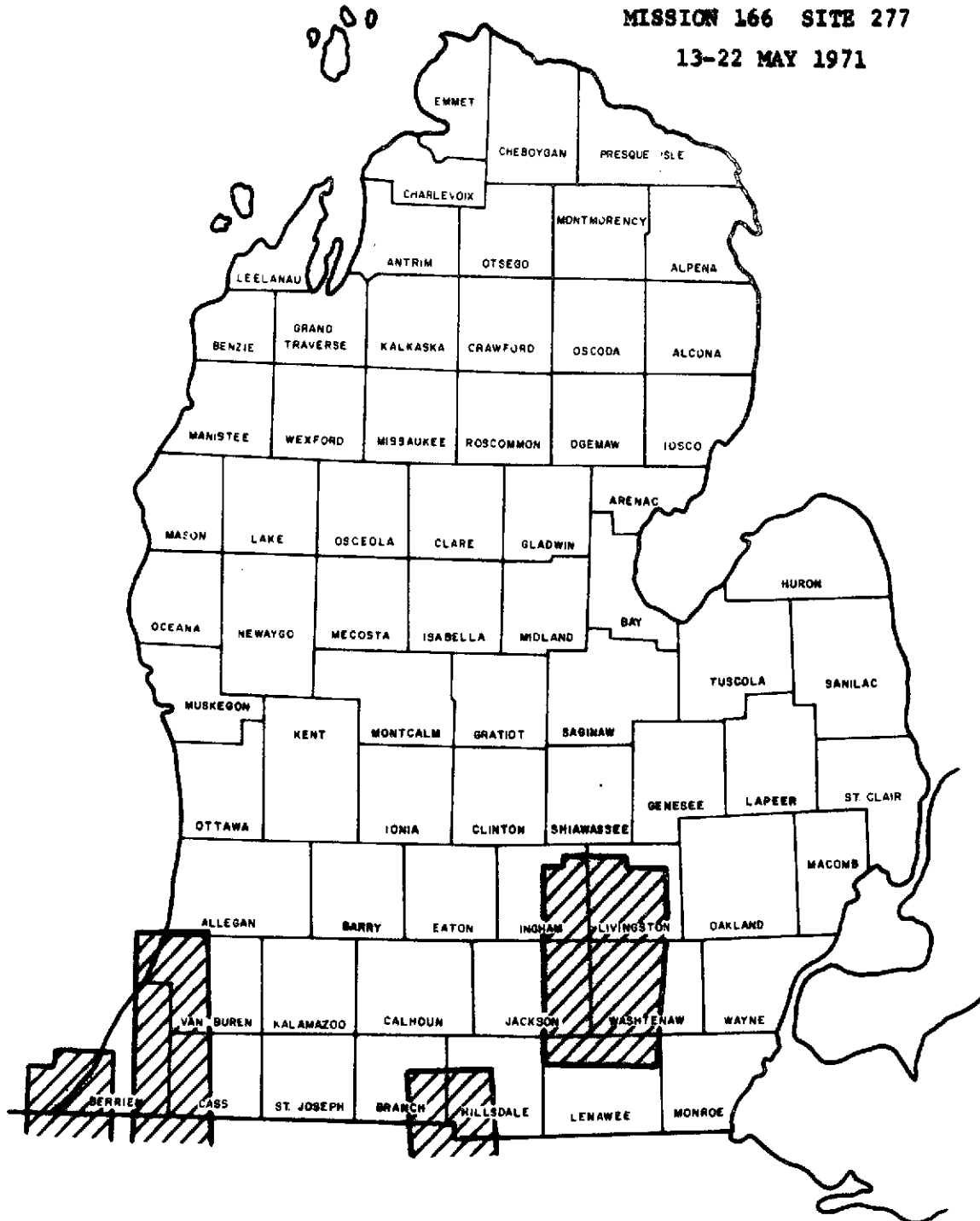
Mission 166, part of a corn blight study, was flown over two test sites in Michigan (Figure 14). Test Site 190 was flown on May 22, 1971. Six north-south flight lines covered an area bounded by Tecumseh on the south and by Howell on the north. One RC-8 and the Zeiss camera held CIR film; the second RC-8 held conventional color. The Hasselblads were again split between black and white panchromatic, BWIR, and CIR film. The flights over this site were made at about 12,200 meters (40,000 feet) elevation.

Test Site 277 consisted of three small arms along the southern border of Michigan. These areas were flown on May 16, 17 and 22, 1971 at an altitude of about 18,300 meters (60,000 feet). Only one camera was carried on these flights: an RC-8 with CIR film.

One set of imagery on the flight line running south from Lakeside, Michigan shows heavy cloud cover and is not usable. All other imagery from this set is usable.

MISSION 166 SITE 190
22 MAY 1971

MISSION 166 SITE 277
13-22 MAY 1971



0 50 miles

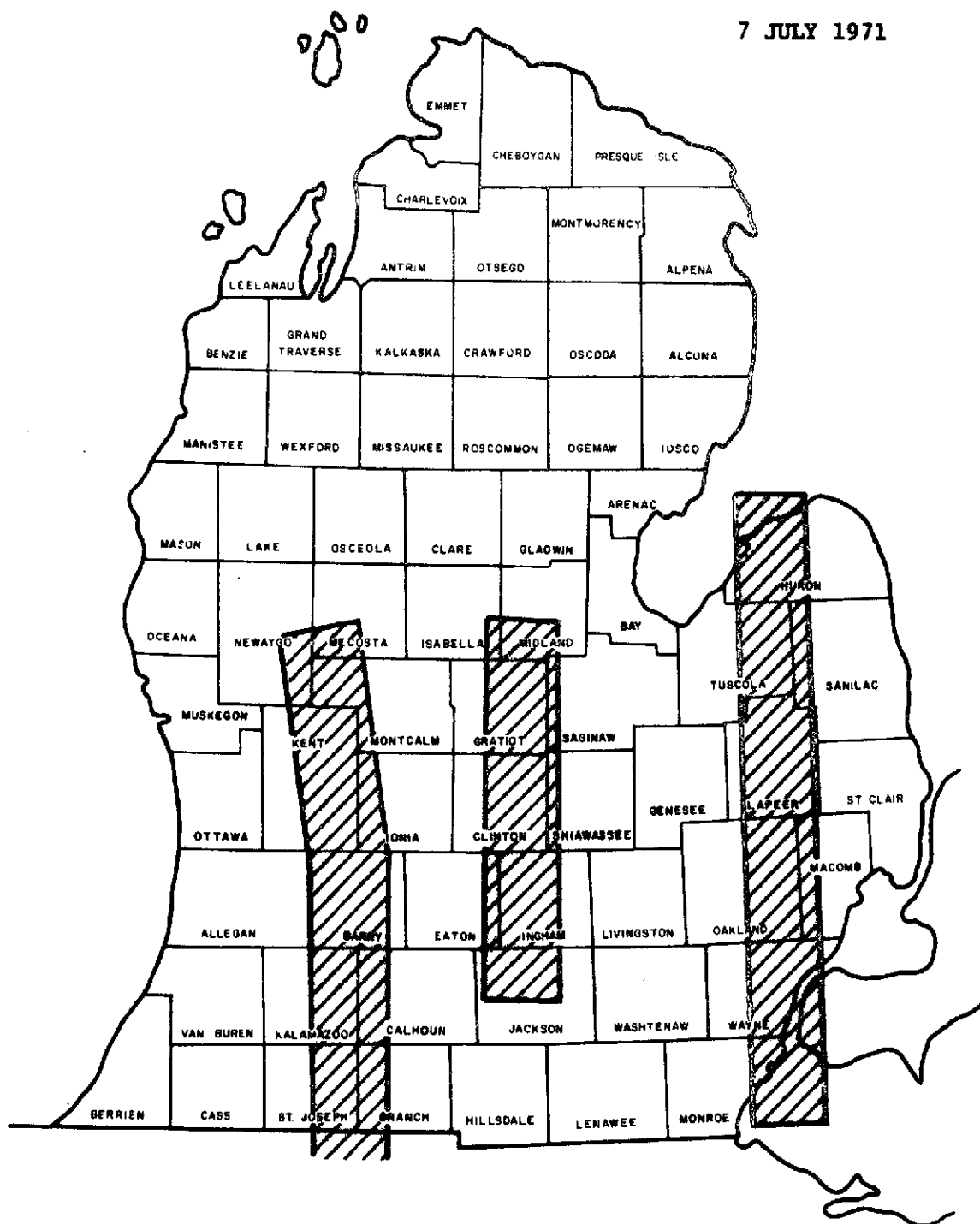
FIGURE 14

MISSION 174 - July 1971

Mission 174, Test Site 274, was an element of the Corn Blight Watch flown in the midwest during 1971. It includes four flight strips in Michigan, collected on July 7, 1971 (Figure 15). One flight line extends northward from Stony Point Ohio on Lake Erie to Port Austin, Michigan on Lake Huron. The second line extends north from about Jackson to near Midland, passing directly over Lansing. The third and fourth flight lines extend north from a point on the Indiana border to the northern border of Montcalm County. They pass between Battle Creek and Kalamazoo and east of Grand Rapids. The RC-8 camera on this mission carried CIR film. The mission was flown at approximately 18,300 meters (60,000 feet) altitude. The imagery is excellent.

MISSION 174 SITE 277

7 JULY 1971



0 50 miles

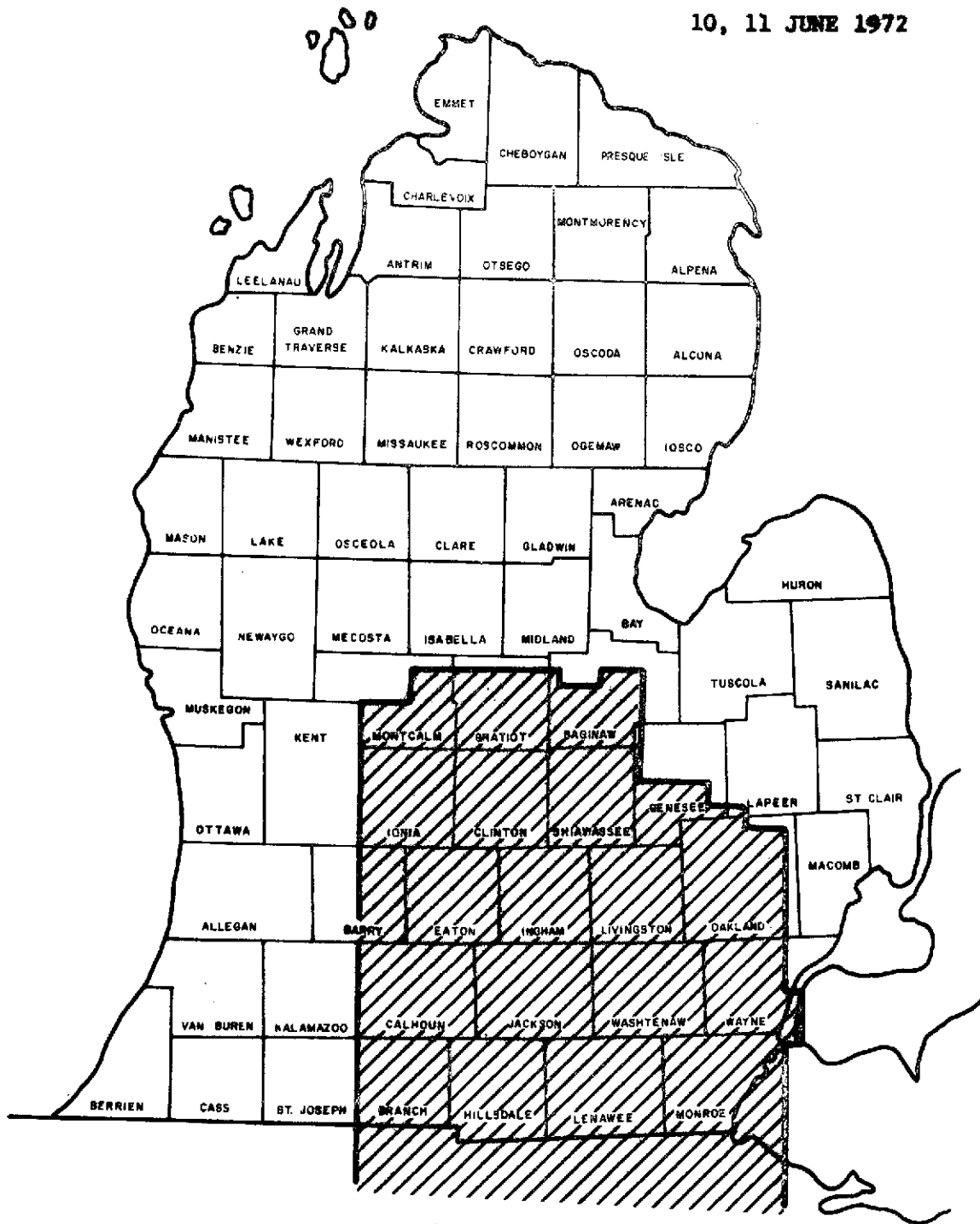
FIGURE 15

MISSION 205 - June 1972

Mission 205, Test Site 279, was flown on June 10 and 11, 1972 (Figure 16). It consisted of south-north flight lines extending from just east of Detroit to west of Lansing, and from the Ohio border north to the latitude of Flint, Michigan. One of the RC-8 cameras and the Zeiss camera contained color infrared film, while the second RC-8 camera held color film. Also, several rolls of 70-mm. film were exposed in the Hasselblad camera bank using filters to obtain photographs of different portions of the spectrum. The aircraft flew at an altitude of about 18,000 meters (59,000 feet). The imagery is excellent.

MISSION 205 SITE 279

10, 11 JUNE 1972



0 50 miles

FIGURE 16

MISSION 211 - September 1972

Mission 211, Site 279, was flown in association with ERTS-1 and a study of the effects of a redhumped oak worm infestation in western Michigan (Figure 17). The coverage extends from Detroit, west to Kalamazoo, and north from the Ohio border to about Flint. A second portion of the site is a section north of Grand Rapids to central Manistee County and south to central Newaygo County, then from central Osceola County to just east of Lake Michigan. The film combinations were the same as Mission 205 and provided two rolls of color infrared film (1:60,000 and 1:120,000) and one roll of color (1:120,000), with several rolls of 70-mm. black and white film. The imagery is of excellent quality.

4

1

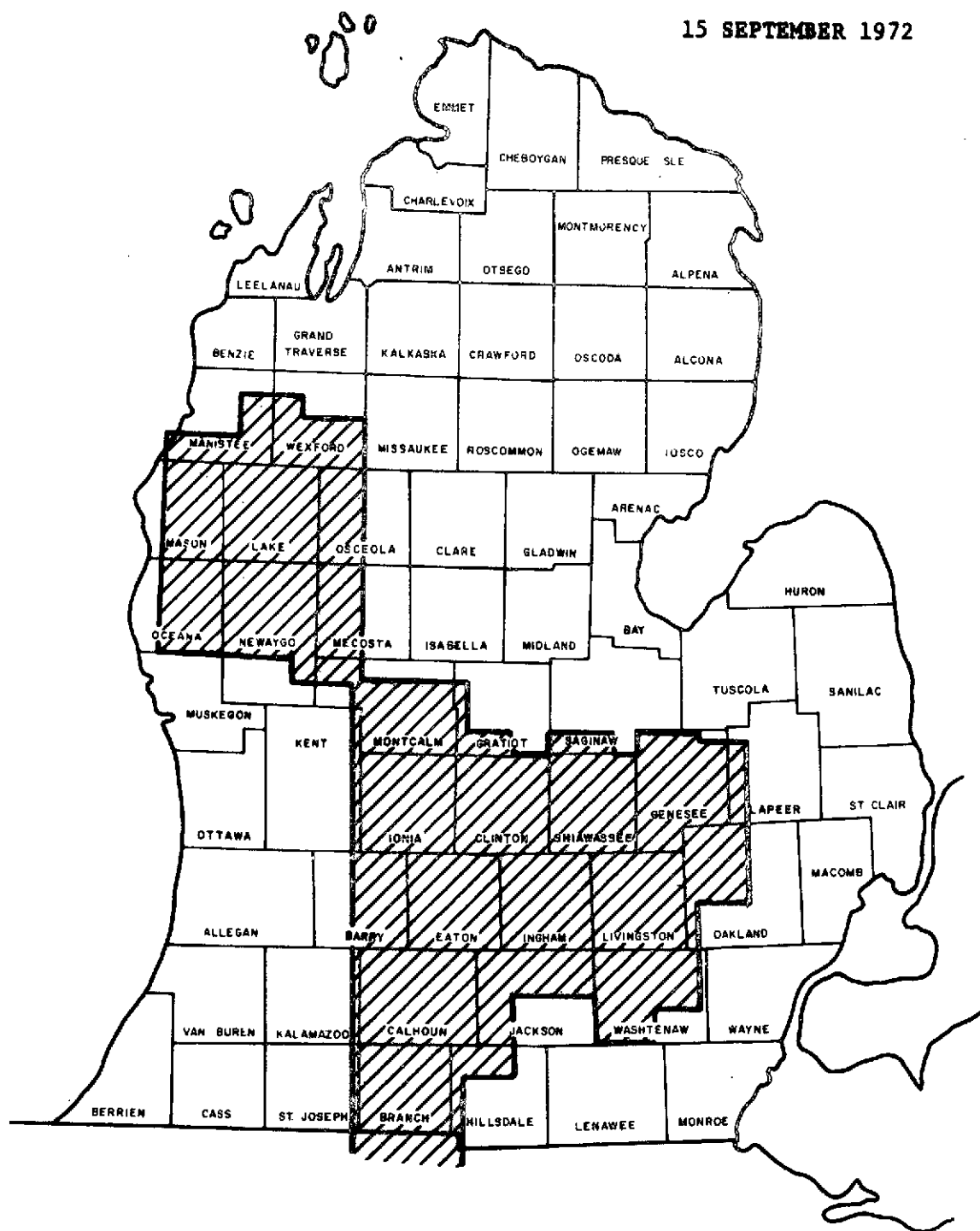


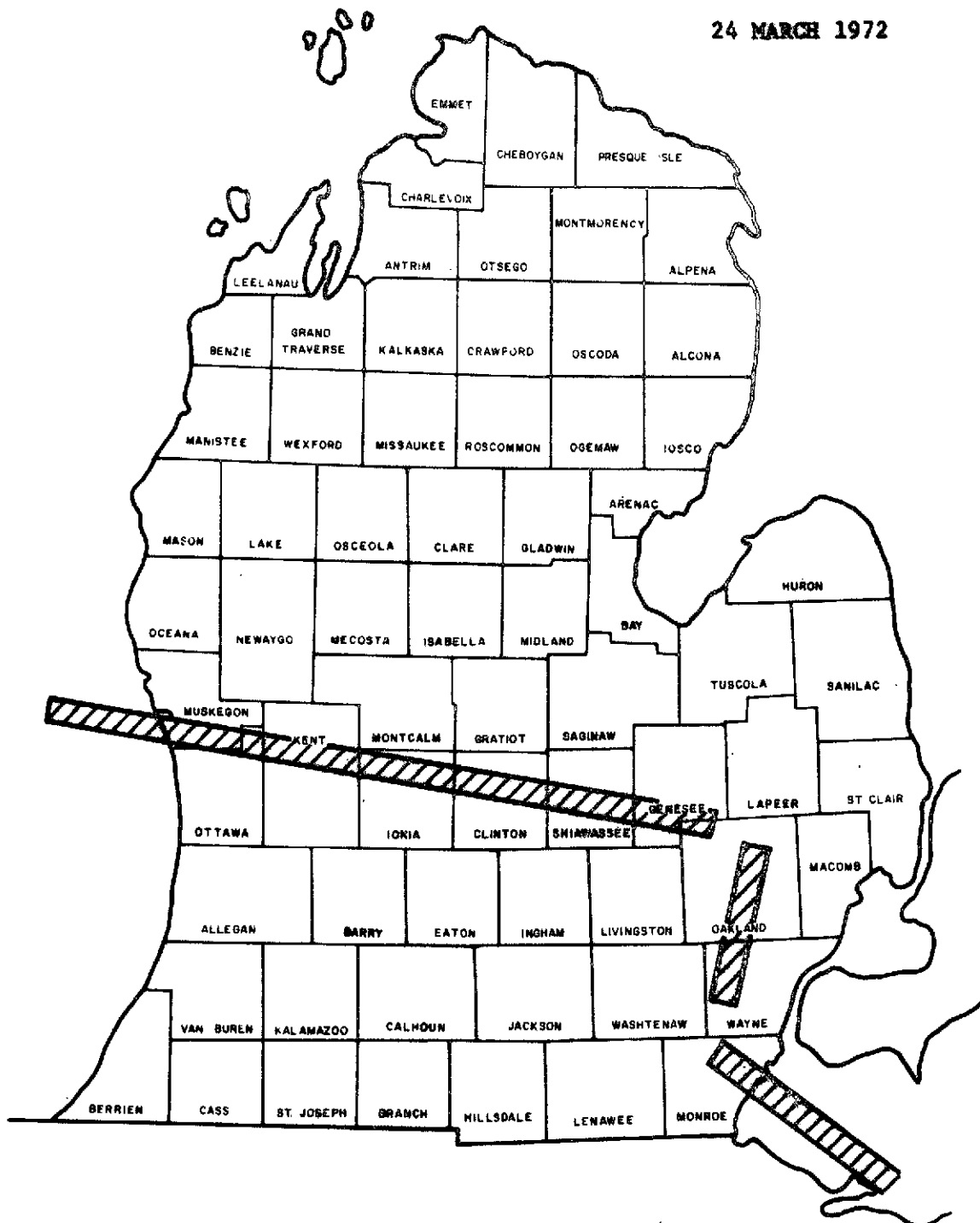
FIGURE 17

Flight 72-047 (U-2) - March, 1972

This imagery was collected on March 24, 1972 in a series of flight lines extending west to east from Muskegon to Pontiac and from Detroit's Metro Airport south-southeast to Cleveland (Figure 18). The flight line was occasionally cloud covered. A Vinten camera system was used, consisting of four 70-mm. cameras holding black and white panchromatic and color infrared film. The aircraft elevation was about 18,800 meters (65,000 feet) giving a scale of 1:446,000. The imagery is generally good.

FLIGHT 72-047

24 MARCH 1972



0 50 miles

FIGURE 18

AVAILABLE IMAGERY

Michigan State University and the Environmental Research Institute of Michigan are acquiring from NASA all available high altitude imagery of the State of Michigan. Primary emphasis at this time is being placed on the color infrared imagery gathered on each flight. As of March 1, 1973, the imagery collected jointly by the two groups is shown in Table III.

TABLE III
IMAGERY COLLECTED JOINTLY BY MICHIGAN STATE UNIVERSITY AND ERIM

Mission 103/167:	Color Infrared, RC-8 camera, 1:120,000 scale
	Color Infrared, Zeiss camera, 1:60,000 scale
Mission 103/191:	Color Infrared, RC-8 camera, 1:120,000 scale
	Color Infrared, Zeiss camera, 1:60,000 scale
Mission 111/196:	Color Infrared, RC-8 camera, 1:120,000 scale
Mission 128D/321:	Color Infrared, RC-8 camera, 1:120,000 scale
Mission 132/190:	Color Infrared, RC-8 camera, 1:120,000 scale
Mission 144/167:	Color Infrared, RC-8 camera, 1:120,000 scale
Mission 145/190:	on order
Mission 166/190:	on order
Mission 166/277:	on order
Mission 174/274:	Color Infrared, RC-8 camera, 1:120,000 scale
Mission 205/279:	Color Infrared, RC-8 camera, 1:120,000 scale
	Conventional Color, RC-8 camera, 1:120,000 scale
	Color Infrared, Zeiss camera, 1:60,000 scale
Mission 211/279:	Color Infrared, RC-8 camera, 1:120,000 scale
	Conventional Color, RC-8 camera, 1:120,000 scale
	Color Infrared, Zeiss camera, 1:60,000 scale

As additions or corrections are made to this list, they will be published.

Michigan State University's Remote Sensing Project is funded by the National Aeronautics and Space Administration to assist users in learning about applying NASA imagery. Although MSU and ERIM do not have the imagery described here for sale they do encourage interested users to ask about and examine the imagery for their own applications. For those who wish to purchase the imagery, the Appendix indicates costs of prints and enlargements from the EROS Data Center.

APPENDIX - AVAILABILITY OF IMAGERY

Further information on the availability of the high altitude photography described in this guide, or specifications on the sensor, aircraft, film, filters, or processing may be obtained from any one of the addresses below:

Project for the Use of Remote Sensing
In Land Use Policy Formulation
201 UPLA Building
Michigan State University
East Lansing, Michigan 48823

Phone: 517-353-7195

Technology Applications
Infrared and Optics Laboratory
Environmental Research Institute
of Michigan
Ann Arbor, Michigan 48107

Phone: 313-483-0500, ext. 366

EROS Data Center
10th & Dakota Avenue
Sioux Falls, South Dakota 57198

Phone: 605-339-2270

The cost of contact prints and enlargements from the EROS Data Center are indicated below.

<u>Number of Prints</u>	<u>Unit Price</u>	
	<u>Over</u>	
<u>Imagery Desired</u>	<u>1-25</u>	<u>25</u>
<u>Black and White</u>		
<u>Prints</u>		
<u>Contact Size</u>		
70-mm.	\$1.25	\$1.00
9" X 9"	1.75	1.25
<u>Enlargements</u>		
10" X 10"	1.75	1.25
20" X 20"	3.50	3.00
30" X 30"	4.50	3.50
40" X 40"	9.00	8.00
<u>Positive Transparencies</u>		
<u>Contact Size</u>		
70 mm.	2.50	2.50

<u>Color</u>
<u>Prints</u>
<u>Contact Size</u>
70-mm. \$4.00 \$2.50
10" X 10" 7.00 3.00
<u>Enlargements</u>
10" X 10" 7.00 3.00
20" X 20" 12.00 9.00
30" X 30" 17.00 13.00
40" X 40" 25.00 20.00
<u>Positive Transparencies</u>
<u>Contact Size</u>
70-mm. 4.00 2.50
<u>Enlargements</u>
10" X 10" 7.00 4.00
20" X 20" 15.00 8.00
30" X 30" 19.00 15.00
40" X 40" 27.00 22.00

SUPPLEMENTARY REPORTS

The information presented in this report includes only that which was available as of April, 1973. As more NASA data becomes available, descriptions of its location and quality can be supplied to you if you so request. If you wish to obtain any of these supplementary reports or additional copies of this publication, please fill out the coupon below and return it to:

Project for the Use of Remote Sensing
In Land Use Policy Formulation
201 UPLA Bldg.
Michigan State University
East Lansing, Michigan 48823

Date _____

NAME _____

POSITION OR TITLE _____

AGENCY _____

ADDRESS _____

ZIP CODE _____ PHONE NO. _____

_____ Please send me _____ additional copy of the
Users Guide to High Altitude Imagery of Michigan.

_____ Please keep me informed of any additions to the list
of NASA imagery available.

_____ Comments:

Could this document be made more valuable to your needs?
Please tell us how we might improve it.